Practitioner Review: Twenty years of research with Adverse Childhood Experience (ACE) scores: advantages, disadvantages and applications to practice

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Abstract

Background: Adverse childhood experience (ACE) scores have become the dominant approach for considering childhood adversities and are highly influential in public policy and clinical practice. Their use is also controversial. Other ways of measuring adversity - examining single adversities, or using theoretically or empirically driven methods - might have advantages over simple ACE scores.

Methods: In this narrative review we critique the conceptualisation and measurement of ACEs in research, clinical practice, public health and public discourse.

Results: The ACE score approach has the advantages – and limitations – of simplicity: its simplicity facilitates wide-ranging applications in public policy, public health and clinical settings but risks over-simplistic communication of risk/causality, determinism and stigma. The other common approach – focussing on single adversities - is also limited because adversities tend to co-occur. Researchers are using rapidly accruing datasets on ACEs to facilitate new theoretical and empirical approaches but this work is at an early stage, e.g. weighting ACEs and including severity, frequency, duration and timing. More research is needed to establish what should be included as an ACE, how individual ACEs should be weighted, how ACEs cluster, and the implications of these findings for clinical work and policy. New ways of conceptualising and measuring ACEs that incorporate this new knowledge, while maintaining some of the simplicity of the current ACE questionnaire, could be helpful for clinicians, practitioners, patients and the public.

Conclusions: Although we welcome the current focus on ACEs, a more critical view of their conceptualisation, measurement, and application to practice settings is urgently needed.

Childhood adversities have long been known to be associated with poor health and other outcomes across the lifecourse e.g.(Hughes et al., 2017). The availability of the Adverse Childhood Experiences (ACEs) Questionnaire and demonstration of dose-response associations between the number of ACEs and a wide range of physical and mental health problems has led to an exponential increase in research (Kelly-Irving & Delpierre, 2019) and, more recently, policy interest in ACEs e.g.(Couper & Mackie, 2016). However, the ACEs field has been strongly criticised. The aim of this review is to highlight the research evidence and current applications of ACEs research to practice. The evidence and its application have been limited in two overarching ways involving *conceptual* and *measurement* issues. Specifically, we focus on cumulative risk (e.g. ACE scores), single adversity approaches, theoretically- and empirically-driven methods for measuring childhood adversities, and their advantages and disadvantages. We then consider the ways ACEs research is applied to clinical practice, public policy and public health programmes, exploring the intended goals and potential

challenges of these activities. We end with a series of recommendations for researchers and practitioners for the future of ACEs research and its application.

Methods

Whilst this is a narrative rather than systematic review, our literature search methods included searching Medline, PsychINFO, key child maltreatment journals (e.g. Child Abuse and Neglect and Child Maltreatment) and clinical child and adolescent mental health journals (e.g. Journal of the Child Abuse and Neglect, Journal of Child Psychology and Psychiatry, Clinical Child Psychology and Psychiatry) using search terms such as "abuse and neglect" and "adverse childhood experiences". Additional relevant papers were sourced via reference lists and Google Scholar searches for terms such as "child abuse and neglect*cluster/overlap/polyvictimisation" and "adverse childhood experiences". Google Scholar search alerts for similar terms and journal content alerts were followed for at least two years prior to drafting this review. We also asked research, policy and clinical experts to read early drafts to ensure we were up to date with practice and policy initiatives.

What is an ACE? Conceptual issues

Childhood adversity is 'a construct in search of a definition' (McLaughlin, 2016) p.363 and a fundamental consideration in ACEs research and translation is what constitutes an 'adversity'? There has been much recent debate on this issue, beyond the scope of this review: we refer the reader to other authors for considerations about whether wider societal risks, such as community dysfunction and ethnic minority status, should be considered as adversities (Cronholm et al., 2015; Edwards et al., 2017; Hartas, 2019; McEwen & Gregerson, 2019). We consider adversities to be *those experiences which require significant adaptation by the developing child in terms of psychological, social and neurodevelopmental systems, and which are outside of the normal expected environment,* adapted from (McLaughlin, 2016). ACEs investigated thus far typically include the same ACEs as the

study by Felitti and colleagues (1998). This study asked more than 8,000 adults presenting at the Kaiser Permanente San Diego Health Appraisal Clinic for a medical examination between 1995-1996 to complete a questionnaire on ACEs. The ACEs included were abuse (psychological, physical and sexual) and household dysfunction (living with a household member with substance abuse problems, mental illness or who had ever been to prison, and mother was treated violently). The ACEs included were expanded by Anda et al (1999) to add parental separation/divorce, and emotional and physical neglect were later included by Dong et al (2004). These ten ACEs have been used in many subsequent studies and in translation to practice. However, the choice of these ACEs has rarely been questioned. No rationale for inclusion of those specific adversities, or for not including others, was given in the original Felitti paper (1998). Many subsequent studies have included additional ACEs. In a systematic review of studies assessing the association between ACEs and cardiovascular risk factors (Appleton, Holdsworth, Ryan, & Tracy, 2017), a third included socioeconomic factors as ACEs and a third included parenting styles – both conceptually distinct from psychosocial adversities.

ACE screening tools are consequently far from uniform (Bethell et al., 2017); the ACE Questionnaire (ACE-Q) used by the Center for Youth Wellness (Bucci et al., 2015) includes the same items from the Felliti study, whereas the World Health Organisation ACE International Questionnaire (ACE-IQ) includes additional adversities such as bullying, war and parental death (WHO, 2018). Finkelhor and colleagues (2013) suggest that associations between ACE scores and health are improved when adversities, such as peer rejection, peer victimisation, and community violence, are added. These varying conceptualisations make comparison of study findings challenging and can create tensions about how different studies should inform practice.

Another conceptual issue is the yes/no nature of ACE recording: individuals are usually assigned into simply *experiencing* or *not experiencing* each adversity (Evans, Li, & Whipple, 2013). This means that risk is arbitrarily attributed and the severity of experience, frequency and duration of experience are

not considered. For example, neglect could be conceptualised as an event or a condition: being left unattended for a short time probably would not constitute neglect but repeated and ongoing lack of supervision would. Most studies (77%) identified in Appleton's (2017) systematic review used unweighted cumulative risk scores and only three studies weighted adversities by their perceived severity (Crowell et al., 2016; Davis et al., 2014; Slopen, Koenen, & Kubzansky, 2014). The adult life events literature could potentially offer guidance on how to better model severity and frequency data. In 1979 Ross and Mirowsky reviewed the life events literature and suggested that simply adding up undesirable events was still giving the best prediction of psychiatric symptomatology (Ross & Mirowsky, 1979). Despite their proposing more sophisticated weighting systems, such as weighting adversities according to their statistical effect, this body of literature, now forty years old, does not appear to have influenced modern ACEs research.

The key conceptual issues in ACEs research are summarised in Table 1, alongside some considerations/recommendations that researchers might take into account in future studies. Such issues are central for informing future ACEs research and translation into practice, and for considering measurement (considered in the next section).

How are ACEs measured? Comparison of different approaches and their strengths and limitations

The way in which adversities have been *measured* in previous studies are limited. We consider strengths and limitations of the commonly used approaches in research studies: cumulative risk or ACE scores; single adversities; and data- and empirically-driven methods.

Cumulative risk scores

A cumulative risk approach involves summing different adversities to represent the total number of adversities experienced by an individual. The cumulative risk approach to adversities was first applied by Holmes and Rahe (1967) in their Schedule of Recent Experiences. This was a checklist of major life events retrospectively reported by adults. Each event was weighted in a somewhat arbitrary fashion by a series of external 'judges' and each event assigned a score between 1 (not stressful) and 100 (very stressful) "Life Change Units", then summed to create a total score. The cumulative risk score approach was first applied to *childhood* adversities in the Isle of Wight study (Rutter, 1978) in which a 'Family Adversity Index' was constructed by summing exposure to disadvantaged parental socioeconomic position, large family size, marital discord, maternal psychopathology, foster care placement and parental criminality. This study found that children with four or more family adversities had the highest risk of child conduct disorder.

The premise behind cumulative risk scores is that childhood challenges in a single domain are easier to negotiate than challenges occurring within multiple domains, echoing Bronfenbrenner's (1979) Ecological Systems theory. The cumulative risk approach for predicting child outcomes was later applied by Werner and Smith (1982) to show that children who had four or more risk factors at age 2 exhibited poorer adjustment in adolescence. Similarly, Sameroff and colleagues (1987) showed that a cumulative risk score comprising ten aspects of the family social environment[1] was associated with poorer cognitive and socioemotional development in children in the Rochester Longitudinal Study.

The most highly cited and widely replicated approach to cumulative risk in childhood adversities comes from Felitti and colleagues (1998). The participants of the Adverse Childhood Experiences study were asked whether they had experienced abuse (psychological, physical and sexual) and

[1] Family social support (father absent), family size (4+ children), stressful life events (25% most), ethnic minority group (non-white), occupation of the head of household (semi- or unskilled), chronicity of maternal psychopathology (≥1 contact), maternal anxiety (25% most anxious), parental perspectives (25% lowest), maternal interactive behaviours (25% least), and maternal education (no high school).

household dysfunction (living with a household member with substance abuse problems, mental illness or who had ever been to prison, and mother was treated violently) as a child. These seven adversities were summed to create an 'ACE score'. The authors showed strongly graded relationships with a range of health outcomes, including risky health behaviours, heart disease, cancer, stroke, type 2 diabetes, chronic bronchitis, fractures, hepatitis and poor self-rated health. The ACE score has since become the dominant approach in ACEs research and has been replicated in hundreds of studies with wide ranging outcomes, such as depression (Chapman et al., 2004), alcohol use (Dube et al., 2006), obesity (Isohookana, Marttunen, Hakko, Riipinen, & Riala, 2016), premature mortality (Kelly-Irving et al., 2013), receipt of disability pension (Björkenstam, Hjern, & Vinnerljung, 2017) and sleep disorders (Kajeepeta, Gelaye, Jackson, & Williams, 2015).

Strengths of ACE scores

The main advantages of the ACE score approach are that:

- It is simple to calculate and understand. Consequently it has been considered a useful tool for engaging non-academic audiences in considering how early life social circumstances might have long-term effects on population health (McLaughlin & Sheridan, 2016).
- From a statistical perspective, by summing several variables, researchers are more likely to find strong, statistically significant associations which are more likely to be 'harder hitting' and easier for engaging with non-academic audiences (Evans et al., 2013).
- The use of ACE scores acknowledges the high level of co-occurrence of different childhood adversities (Dong et al., 2004; Felitti et al., 1998) and that, on average, experiencing more adversities is associated with poorer outcomes. Between 81-98% of respondents in the Kaiser Permanente study who reported one ACE also reported at least one other (Dong et al., 2004).

- ACE scores have also been used as simple practice tools for identifying people at the highest risk of poor outcomes, e.g.(Center for Youth Wellness, 2017). However, care is needed in directly translating risk from population level studies to individuals (discussed below).

Limitations of ACE scores

- The ACE score approach assumes that each adversity is equally important for outcomes (McLaughlin, Sheridan, & Lambert, 2014), which is unlikely.
- ACE scores disregard the specific patterning of ACEs. A child who witnesses domestic violence, parental divorce and has a parent with a mental health problem is assigned an ACE score of three, as is a child who experiences emotional, physical and sexual abuse. This implies that both children have the same risk of poor outcomes – another unlikely assumption.
- ACE scores are uninformative in elucidating the mechanisms through which adversities might lead to poorer outcomes individually and with other adversities. We need to know about the effects of separate adversities, *how* and *which* different adversities interact or co-occur and the effects of these patterns of co-occurrence (Lanier, Maguire-Jack, Lombardi, Frey, & Rose, 2018).
- The ACE score approach assumes that everyone with the same ACE score will receive the same benefit from an intervention regardless of what those adversities were. Understanding mechanisms is key to developing better interventions. At present a “one size fits all” approach to practice and policy is assumed, because we have limited knowledge on how different ACE combinations affect health (Lanier et al., 2018).
- Revisiting Felitti’s (1998) study there was no rationale for why the adversities were summed rather than applying other statistical approaches to deal with the co-occurrence of adversities. Associations between ACE scores and outcomes might be driven by the effect of one or a sub-set of adversities. Despite the known limitations of simple summative

approaches, and the longstanding existence of more sophisticated approaches (e.g. Ross & Mirowsky, 1979), the cumulative risk approach has rarely been questioned.

- There has been a reliance on retrospective reporting of ACEs despite poor agreement between prospective and retrospectively-reported ACEs (Baldwin, Reuben, Newbury, & Danese, 2019; Newbury et al., 2018). Longitudinal research has shown that retrospectively recorded ACEs are more strongly associated with health outcomes than those that were objectively assessed prospectively (Reuben et al., 2016).
- Few studies have considered the importance of timing, chronicity and discontinuity of adversities, although there are some exceptions (Alastalo et al., 2013; Crowell et al., 2016; Davis et al., 2014; Friedman, Montez, Sheehan, Guenewald, & Seeman, 2015; Schooling et al., 2011; Slopen et al., 2014, 2015). Few studies use repeated ACE scores at different ages, and often just use a single ACE score for the whole of childhood/adolescence (Howe, Tilling, & Lawlor, 2015). There has been a greater focus on adult outcomes with less focus on how ACEs might affect children. This is likely driven by the reliance on retrospective reporting in adult populations but also by issues surrounding the disclosure of adversities by children (considered later).

The use of cumulative ACE scores has been profoundly influential in medical and social science, practice and policy, but developments of the ACE score approach will be necessary before meaningful progress can be made on mechanisms, protective factors, and the development of more focussed preventative and treatment interventions for ACE-associated poor outcomes.

Alternative approaches to measuring ACEs

What are the alternative approaches to measuring ACEs in research and their implications for practice? We consider three common methods – single adversities; theoretically driven models; and empirically driven methods.

Single adversity approaches

There are thousands of research studies, many long pre-dating the focus on ACE scores, which examine one single adversity. There are also studies that disaggregate the ACE score into its component parts and examine the effect of each adversity independently. For example Merrick and colleagues (2017) used the Kaiser Permanente study to examine associations between each ACE and health without adjusting for the effect of each of the other adversities, making it possible to compare the strength of associations between different adversities and specific outcomes. The strongest associations were observed between parental substance misuse and the participant's own engagement with risky health behaviours. Dennison et al (2017) found associations of differing magnitude between trauma (assessed via the Childhood Trauma Questionnaire), caregiver neglect and food insecurity on reward processing. Alcala et al (2018) also found different associations between different adversities and outcomes; participants who reported childhood physical abuse were less likely to attend prostate, breast or cervical screening, while no associations were observed between sexual abuse and screening attendance. The key strength of these single adversity approaches is that one can examine the potential mechanisms linking a specific adversity to a specific outcome (McLaughlin, 2016), but this is an under-researched area.

The main limitation of the single adversity approach is that it ignores the presence of other adversities when we know there is a high level of co-occurrence (Finkelhor, Ormrod, & Turner, 2007). It is therefore possible that any association observed between a specific adversity and outcome is in fact explained by the experience of other adversities not accounted for in the analysis. The increasing recognition of the clustering of adversities has resulted in a decline in the single adversity approach and a subsequent increase in research which applies an ACE score approach (McLaughlin et al., 2014) – with the limitations we have already discussed.

Theoretically driven models of adversity

The appreciation of the clustering of adversities and the limitations in ACE scores has resulted in theoretically driven dimensional models of adversity. Dimensional models group adversities according to how they might similarly affect a specific outcome. For instance, McLaughlin and colleagues (2014) proposed a *Dimensional Model of Adversity and Psychopathology (DMAP)*, suggesting that *deprivation*- (e.g. institutionalisation, neglect and poverty) and *threat-based* adversities (e.g. abuse) affect psychopathological outcomes to a similar extent but via different mechanisms. Evidence from animal studies shows that deprivation-based adversities affect neurodevelopment through the absence of stimulation leading to excessive pruning of synapses in the Central Nervous System e.g. (Bennett, Rosenzweig, Diamond, Morimoto, & Hebert, 1974) and that the effects of deprivation on CNS structure are reversible following exposure to enriched, cognitively stimulating environments (Diamond, Rosenzweig, Bennett, Lindner, & Lyon, 1972). Threat-based adversities are thought to affect neurodevelopment through changes in amygdala and hippocampal functioning resulting in altered emotional development (van Marle, Hermans, Qin, & Fernández, 2009). However, it could be argued that neglect and deprivation are not mutually exclusive domains, as threat responses might be mobilised by having unmet needs. DMAP was recently empirically tested and studies have shown that threat- and deprivation-based adversities affect outcomes such as internalising and externalising behaviours (Miller et al., 2018), physiological reactivity to stressful tasks (Busso, McLaughlin, & Sheridan, 2016) and biological ageing (Sumner, Colich, Uddin, Armstrong, & McLaughlin, 2018) via different mechanisms.

Several other theoretical groupings have been suggested, such as by *harshness* and *unpredictability* (Belsky, Schlomer, & Ellis, 2012; Ellis, Figueredo, Brumbach, & Schlomer, 2009; McLaughlin et al., 2014), the interconnectedness of different forms of *interpersonal violence* (Hamby & Grych, 2013), *familial* vs *extra-familial* adversities, *natural disasters* vs *human-caused*, *severe* vs *mild*, or *stigmatising* vs *non-stigmatising*.

The advantages of theoretical models are that, unlike cumulative ACE scores, they recognise that different adversities are likely to have differing mechanisms through which they affect outcomes. However, they are often difficult to test comprehensively, particularly in large population studies, requiring detailed information on both adversities and variables capturing mechanisms.. Until more is known about mechanisms, it will be difficult to group adversities logically . For instance, using the DMAP model, parental separation might have aspects of both *deprivation* and *threat*. Consequently, while these models are promising, mechanistic knowledge is at such an early stage that they are difficult to translate into practice. Further empirical research is required.

Empirically driven methods

Two alternative empirical approaches have emerged in ACEs research – variable-centred (e.g. factor analysis, FA) and person-centred (e.g. latent class analysis, LCA) methods. FA groups ACEs by the degree to which they are correlated with one another. LCA is a person-centred clustering technique that groups people to show the adversities they tend to report. The focus of this approach is on how prevalent different combinations of adversities are and whether different combinations of adversities matter. Recent applications of these methods to ACEs research have found various ways of grouping ACEs or individuals (Caleyachetty et al., 2018, 2016; Denholm, Power, Thomas, & Li, 2013; Green et al., 2010; Lanier et al., 2018; Westermair et al., 2018). For example, Ford et al (2014) applied FA and found three groups of ACEs in the 2010 Behavioral Risk Factor Surveillance System - Household dysfunction (e.g. family member substance misuse, parental separation, parental incarceration); Emotional and physical abuse, and Sexual abuse. In contrast, a FA by Mersky et al (2017) found two groups of adversities: child maltreatment and household dysfunction. A recent study found that the number of clusters and the types of adversity that clustered together varied by age (Brown, Rienks, McCrae, & Watamura, 2017). This suggests that using a single ACE score for the

whole of early life might miss age-variation in when adversities occur and how adversities are reported.

The main advantage of FA and LCA methods, rather than just relying on cumulative counts of ACEs, is that they allow researchers to understand the prevalence and impact of different ACE combinations. These methods also weight adversities depending on their relationship with outcomes of interest and do not assume that each adversity has an equal effect (Ford et al., 2014). These methods have the potential to inform the targeting of interventions to address specific ACE patterns and to prioritise interventions for children who report the most problematic combinations (Lanier et al., 2018). More work is needed (including examining how certain groupings predict outcomes) before we can come to a consensus about how best to group ACEs and what this means in terms of mechanisms, prevention and treatment.

Empirically driven methods have their limitations. First, we still know little about the predictive power of FA and LCA-derived adversity variables, although interesting findings are beginning to emerge; in the US National Longitudinal Study of Adolescent to Adult Health, adversity variables derived by FA more strongly predicted later depressive symptoms and heavy drinking than a simple ACE score (Brumley, Brumley, & Jaffee, 2018). Second, we do not know whether clusters derived via FA or LCA share similar mechanisms leading to poorer outcomes or whether these occur to the same people. Third, large sample sizes are needed, particularly when there is a need to compare different adversity dimensions simultaneously. Fourth, these methods effectively omit adversities which are not correlated with other adversities (Evans et al., 2013), potentially missing an independent effect of that adversity. Fifth, findings derived from these methods are analysis-specific and therefore difficult to translate across studies, as different studies might find different numbers and types of adversity clusters. Some trends across studies are emerging; a systematic review of studies applying person-centred methods to child maltreatment found that most studies identified ‘low risk’ and

'polyvictimisation' clusters (Debowska, Willmott, Boduszek, & Jones, 2017). Finally, most of the research that has applied empirical methods, particularly LCA, has focused on the co-occurrence of abuse and neglect rather than on broader ACEs.

The strengths and limitations of the main approaches to adversity measurement are summarised in table 2.

Application of ACEs research to clinical work, public policy and public health programmes

ACE scores and findings from ACE research are used in different ways in *public policy, public health* and *clinical work* with a variety of goals. If we want ACE scores to do more than predict broad population risks and instead prioritise and develop interventions or build models of development, then more nuanced research and applications of that research is needed. In table 3 we consider the ways ACEs research is currently used in each of these activities in turn, along with their goals and challenges.

Public Policy

In the Public Policy arena, there are two main ACE-related activities: 'ACE awareness' for the general population and the development of 'Trauma-informed' public services.

Increasing public awareness – 'ACE awareness'

Findings from population level studies are frequently used to raise public awareness of the potential long-term effects of ACEs (increasing 'ACE awareness'). Scotland and Wales aim to become the 'first ACE-Aware Nations' (ACEawareScotland, 2018; ACEawareWales, 2019). The ultimate goal is to prevent ACEs in the first place (primary prevention) and to reduce violence through creating a more

compassionate society. Whilst these goals are merited, care should be taken that the messages from ACEs research are not communicated in a deterministic way. Crucially, risk at the population level does not imply that *an individual* is going to have negative future outcomes, yet many of the current educational materials about ACEs imply just this e.g.(Ford et al., 2016; PublicHealthWales, n.d.). If the ACE-aware movement gains momentum and the language of ACEs becomes current in society, there could be unintended negative effects on children if, say, a ten-year-old child with a history of multiple adversities comes to feel stigmatised and doomed to poor physical and mental health. It is crucial that alongside public discussion of ACEs there is at least as much emphasis on resilience and potential for change towards more positive trajectories. Linked to this, much of the current public education about ACEs assumes that they have a causal role in negative outcomes, yet most research on ACEs is correlational and was conducted retrospectively. There is therefore the potential for recall bias and confounding. Recent behavioural genetic research has shown that, although co-occurring neurodevelopmental problems such as ADHD and learning disabilities are more common in children who have experienced abuse and neglect than those who have not, the maltreatment does not appear to cause these overlapping disorders (Dinkler et al., 2017). It may be that children with complex neurodevelopmental difficulties are at higher risk of being maltreated – and it is already known that neurodevelopmental disorders are associated with increased mortality (Woolfenden, Sarkozy, Ridley, Coory, & Williams, 2012). Longitudinal studies have shown that cognitive problems (Danese et al., 2017) and ADHD (Stern et al., 2018) may *precede* abuse and neglect. If ACEs can be the *result* of treatable neurodevelopmental problems such as ADHD then the burden of ACEs could potentially be reduced in the population by better supporting families whose children have these difficulties. Similarly, family economic circumstances are an important determinant of ACEs (Liming, 2018) and a focus on alleviating child poverty might be another mechanism for reducing ACE prevalence in the population. ACE awareness initiatives often have a narrow focus on individual/family level causes of ACEs but little focus on these societal level factors (Fond, Haydon, & Kendall-Taylor, 2015).

Training of frontline workers to be 'trauma informed'

Recent initiatives have trained frontline workers, such as the police, teachers, health and social care workers, to be 'trauma informed' or 'trauma aware' (Ko et al., 2008; NHSHighlands, 2018). Workers are encouraged to recognise that the people they encounter may be in their current situation as a consequence of ACEs (Sullivan, Murray, & Ake, 2016) and to consider 'what happened to you?' rather than 'what's wrong with you?' The aims of 'trauma informed' initiatives are to increase compassion, improve relationships between the public and public service representatives and hence reduce violence. Trauma informed training also aims to minimise the potential long-term effects of ACEs by building resilience (secondary prevention) and preventing re-occurrence (tertiary prevention) (Couper & Mackie, 2016). Trauma informed practices can be extended beyond frontline staff training to all layers of organisations, such as policies and procedures, recruitment and leadership style (NHSHighlands, 2018).

Little is yet known about the impact of trauma informed practices in, for example, improving therapeutic support for children whose traumatic experiences have been recognised (Berliner & Kolko, 2016). As with ACE awareness initiatives, the issues surrounding the communication of risk discussed above also apply to how research findings are presented in training materials. In these public policy campaigns, caution is required to ensure that the public, and public service workers, understand that multiple ACEs do not mean that poor outcomes are inevitable – and that factors such as committed, stable care from nurturing adults are crucial to reduce risk. If conducted well, these public policy approaches have great potential to create a language that transcends public and professional groups, increases partnership working across agencies and, ultimately, increases compassion and reduces violence in society. ACE-awareness campaigns led by governments and supported by a wide range of services, such as are happening in Scotland and Wales, are an

interesting natural experiment. There is an opportunity for rigorous research to test whether these goals can be achieved.

Public Health

Public health approaches overlap with public policy campaigns but are more targeted towards improving population health through prevention and intervention. We have included, here, Routine Enquiry and screening for ACEs.

Routine Enquiry

Routine Enquiry aims to train frontline practitioners to routinely ask all patients/clients about ACEs. The rationale is that, since spontaneous disclosure of ACEs is uncommon, knowledge about ACEs can aid treatment (Read, Harper, Tucker, & Kennedy, 2018). There is little evidence in support of routine enquiry as yet (Ford et al., 2019), however various programmes now exist to encourage it, such as the Routine Enquiry into Adversity in Childhood (REACh) programme commissioned by Public Health Blackburn (RealLifeResearch, 2015). REACh trains practitioners, who have first line contact with adults presenting with risky behaviours and a range of health issues, to routinely conduct ACE questionnaires with their clients with the aim of responding appropriately and planning interventions. In adult mental health services, the use of routine enquiry is growing, but should not be tick box exercises to derive an ACE score but instead be an entry point to further sensitive discussion, support and intervention where indicated. Appropriate and effective services need to be in place to appropriately manage disclosures (Finkelhor, 2018; Howard, 2017).

There have been calls for routine enquiry to be conducted with children and adolescents, but indiscriminate and inappropriate use of ACE questionnaires by untrained staff could be harmful, especially for children (Barrett, 2018). Abuse disclosure in childhood has child protection implications and routine enquiries by adults could affect children's evidence if disclosures lead to

legal proceedings (Andrews, Lamb, & Lyon, 2015). Yet a report by the National Society for the Prevention of Cruelty to Children (NSPCC) describing the process of disclosure for children and young people found that, while 80% of children and adolescents tried to disclose the maltreatment before the age of 18, less than 60% of disclosures were acted upon at the time (Allnock & Miller, 2013). Rather than simply translating principles of adult routine enquiry to children, consideration is needed about how to train children's front line workers to better recognise and 'hear' disclosure.

Screening

The term 'screening' in the ACEs field is often used loosely and sometimes as a synonym for routine enquiry, but is in fact a very different undertaking. Screening is only appropriate when there is a recognisable early stage of disease and when interventions exist that are known to be effective in preventing progression to the full-blown disease state (Andermann, Blancquaert, Beauchamp, & Déry, 2008; Wilson & Jungner, 1968). ACEs do not inevitably lead to disease, so cannot be considered to be such an early stage and it is not ethical or justified to screen for ACEs where effective treatment cannot be assured (Finkelhor, 2017). This crucial difference has been highlighted in the field of domestic violence: like ACEs, domestic violence is not a disease. Instead, both domestic violence and ACEs are 'health-related risk factors' (Taket, Wathen, & MacMillan, 2004). Screening children for ACEs is even more problematic. Detailed 'screening' programmes have been described in the United States where paediatric clinics routinely collect total ACE scores on children via parental or caregiver report (Purewal et al., 2016). It is striking that, in the description of these services, little mention is made of social work or child protection and the ethical issues regarding lack of evidence-based interventions for children with high ACE scores (Finkelhor, 2017).

Use of ACEs information in treatment and treatment planning

Knowledge about ACEs can be helpful in formulating treatment plans for individual patients. Some goals are shared with trauma-informed population approaches e.g. increasing understanding and

compassion for the patient. Understanding from ACEs research has also been helpful in treatment development e.g. knowledge that adversities often co-occur (Hughes et al., 2017) and that ACEs can have clinical correlates that are both general (e.g. stress) and specific (e.g. PTSD) (Cohen & Mannarino, 2008).

The traditional recording of ACEs in mental health and social work practice might actually mask multiple adversities. For example, a child who came into care due to 'intra-familial sexual abuse' would, by definition, also have experienced emotional abuse, physical abuse and neglect (of basic developmental needs). In other words, sexual abuse as a reason for coming into care might actually indicate high co-occurrence of adversities yet treatment programmes often focus solely on sexual abuse (Fletcher, Elklit, Shevlin, & Armour, 2017). The use of a simple ACE score is likely to be limited in informing treatment plans. Children's well-being may best be understood by "using a method that captures the entirety of maltreatment" (McGuire et al., 2018) p.18. Examining individual types of maltreatment, their severity, timing and frequency, as well as exploring maltreatment as a unitary concept encompassing any/all types of maltreatment the child has experienced can be informative (McGuire et al., 2018; Nemeroff & Binder, 2014). This work suggests that, if knowledge about ACEs is to inform treatment plans for children and adolescents, careful, sensitive enquiry about exactly what happened, how severe it was and at what developmental stage is going to be needed. This is what clinicians have been doing for decades – sometimes in liaison with social work colleagues and/or with the help of existing data contained in casefiles or administrative databases. Emerging research suggests that careful integration of existing data, clinical interviewing and observation in a multi-agency framework can be beneficial in reducing ACEs (Dubowitz, Lane, Semiatin, & Magder, 2012) and this will be an important area for future research.

Could new ways of recording and measuring ACEs inform clinical practice?

Patients who experienced ACEs are more likely than the general population to have complex problems that can include both neurodevelopmental (Dinkler et al., 2017) and trauma-related problems (van der Kolk, 2005). Data-driven research approaches might help tease apart the impact of ACEs at different developmental stages and the interplay between ACEs and other key developmental factors. This will require new ways of recording ACEs in administrative datasets. For example, encouraging social services to record all types of maltreatment at the time of entry to care rather than just the reason that precipitated the current episode of care-entry could provide important information for future research. This knowledge could support development of new and more effective treatments for maltreated individuals.

Recommendations for the future of ACEs research and its applications

There is now a large body of evidence showing that ACEs may have long-term consequences, at a population level. This knowledge has resulted in a wide range of policy and practice initiatives, but rigorous research on the benefits and harms of these initiatives is lacking and is urgently needed. The simplicity of ACE scores can help practitioners consider what adversities someone has experienced in childhood and have been useful for highlighting the importance of ACEs amongst broad audiences. However, simple ACE scores have limitations. They have not facilitated the building of the detailed models of development that could better inform clinical and public policy approaches and help prioritise interventions. We argue that it is now time for further research into how different adversities co-occur, which measurement methods to use in which contexts, and how more nuanced findings can be translated meaningfully into clinical practice and public health/policy initiatives, both to prevent ACEs in the first place and to prevent their potential impact across the lifecourse.

Our recommendations for researchers are:

1. To be clearer in their definitions of adversity when reporting research. What definitions were applied in this particular study? What ACEs were included and not included and why?
2. To move beyond the 10 ACEs from the Kaiser Permanente study and take context into account when deciding which additional ACEs to include.
3. To consider alternative approaches to operationalising adversity beyond ACE scores: to consider weighting, clustering and recording of severity, frequency and developmental period. This will help elucidate the life course mechanisms leading to poorer outcomes, and guide intervention developments.
4. Longitudinal studies, recording high quality prospective ACEs data, are crucial to ACEs research, particularly those in which the severity, duration, frequency, timing and patterning of adversities can be taken into account, as well as the direction of associations.
5. Rigorous intervention studies are needed to examine the cost-effectiveness and safety of programmes such as routine enquiry and trauma informed initiatives.

Our recommendations for practitioners are:

1. To be more cautious and sensitive in translating evidence from population research to individual risk in order to reduce stigma and avoid deterministic messages from being propagated.
2. Give careful thought to how and when to appropriately record ACEs in different practice settings. In some situations, e.g. in therapeutic settings, detailed information on specific adversities might be useful but it needs to be recognised that ACEs do not necessarily result in poor outcomes.
3. Consider whether evidence is available on the effectiveness and acceptability of programmes such as Routine Enquiry and Trauma Informed Initiatives before implementation.

4. Only routinely enquire about ACEs where the benefit outweighs any potential harm, and where evidence-based interventions exist and are readily available.
5. Look beyond individuals and families to the broader structural 'causes' of ACEs, such as poverty – especially when developing policy initiatives.

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ACE scores have been instrumental in stimulating an explosion of transformative research into childhood adversity. Innovations in practice are multiplying based on these findings. The challenge now is to find more nuanced ways of measuring and conceptualising ACEs that are still easily usable so that detailed models of development can better inform practice and policy.

Key points

Areas for Future Research

- Researchers need to be clearer about their definitions of adversity – what constitutes an adversity and what does not?
- Researchers should consider including additional ACEs other than the 10 frequently investigated ACEs from the Kaiser Permanente Study and justify these clearly.
- Researchers should explore the different ways in which ACEs tend to cluster cluster and, individually and together, predict outcomes
- Longitudinal studies are required, particularly those which are able to consider the co-occurrence, timing, frequency, duration and severity of ACEs, and which have high quality prospective ACEs data.

Key Practitioner Messages

- Twenty years of adverse childhood experiences (ACEs) research has shown a graded relationship between the number of adversities (ACE score) and health and other outcomes in many different populations, with important implications about the potential impact of ACEs in clinical practice, public policy and public health initiatives.
- In all clinical, public policy and public health uses of ACE scores, appropriate and sensitive communication of messages about risk/resilience and causation versus correlation is crucial in order to avoid detrimental and deterministic messages being propagated. More sophisticated recording of ACEs (e.g. all ACEs experienced rather than just reason for coming into care) will allow development of practice and research understanding of the way ACEs cluster and of their individual and combined impact.
- Before implementing Routine Enquiry about ACEs, careful considerations are required including how data are used, availability of evidence-based interventions, determinism and stigma
- A broader focus on the structural 'causes' of ACEs is also warranted, especially a focus on issues such as poverty and inequality

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Table 1. Summary of conceptual issues and considerations for future ACEs work

Conceptual issues	**Considerations/recommendations for future research**
Lack of internationally agreed definitions of adversity	Be explicit in definitions about what is and is not considered to be an adversity, and why. Conduct research on clustering of ACEs and their relative prognostic significance, both individually and in combination
Assigning individuals into binary categories regarding ACEs (experienced vs not experienced)	Consider including information on perceived severity or effect of experience too, as well as timing and duration of experience.
Lack of justification for using original ten Kaiser Permanente ACEs	Consider inclusion of other adversities too – but justify their inclusion based on clustering and prognostic significance
Differing items in various ACE screening questionnaires	Need for greater consensus on which items to include and why

Abbreviation: ACE = adverse childhood experience

Table 2. Summary of strengths and limitations of the main approaches to measuring adversities

Measurement approach	**Strengths**	**Limitations**
ACE score	- Simple to understand and carry out - More likely to find strong, statistically significant associations with outcomes - Acknowledges that adversities tend to co-occur	-Assumes that each adversity has same association with outcomes of interest - Ignores the specific patterning of ACEs i.e. which adversities tend to co-occur? - Unhelpful if interested in mechanisms through which adversities might affect outcomes - The specific adversities in an ACE score are rarely justified or questioned - Largely reliant on retrospective reports which are likely to be biased/unreliable - Consequently, larger focus on adult outcomes rather than child outcomes

Single adversities	- Can investigate mechanisms linking specific adversities with outcomes of interest - Can compare effects of different adversities	- Ignores the co-occurrence of adversities (i.e. associations seen could be confounded by presence of other adversities)
Theoretically driven adversity models	- Adversities grouped theoretically based on how they are thought to affect outcomes - Therefore useful for investigating mechanisms linking different types of adversities with outcomes	- Often difficult to test in a comprehensive way and to separate adversities into different types
Empirically driven methods (e.g. variable-centred and person-centred methods)	- Allow researchers to better understand the co-occurrence of adversities and the impact and prevalence of different combinations - Adversities are weighted depending on how strongly they influence outcomes - Useful for identifying prevalent and harmful ACE patterns and consequently to prioritise interventions	- Little currently known about the predictive power of these methods and how they compare to other methods, e.g. ACE scores, for outcomes - Require large sample sizes - Often criticised for being 'analysis-specific' and therefore not easily generalised to other populations. However there is evidence of replication of adversity clusters across different

		samples as these methods become more common - Most of the research using these methods has concentrated on maltreatment rather than broader ACEs

Abbreviations: ACE = adverse childhood experience

Table 3. The main ways ACEs are used in public policy, public health and clinical work, their intended goals and challenges

Activity	**Level**	**Intended goals**	**Challenges**
Public policy approaches			
'ACE awareness' promotion - using data from population-level studies to increase public awareness about ACEs	Whole population	- To increase public awareness that ACEs increase risk of physical and mental health problems across the lifespan so ALL of us should be doing what we can to prevent them - To increase public awareness that the opportunity to confide in at least one supportive adult can ameliorate the "impact" of ACEs - To develop "kinder, more compassionate societies" -ultimately to support primary prevention of ACEs, increase compassion and understanding for people who have suffered multiple ACEs	- Correlation ≠ causation - Research findings are often communicated in a deterministic way - Little focus on resilience - Individual level focus despite research findings being at a population level - Lack of rigorous evaluation of programme effects
'Trauma informed' training of frontline staff working with children or adults (e.g. police,	Whole services	- 'Trauma-focussed' encounters with clients/patients i.e. increasing understanding by practitioners of what might have	As above

teachers and health and social care workers) sometimes drawing on service-level audit data. May also include "routine enquiry" about ACEs (see below) by staff		happened to their patients/clients and consequently why they might be in their current situation - Hence to improve client/practitioner relationships, create a more compassionate workforce - Early detection of ACEs during childhood in order to prevent/reduce negative impacts (i.e. Secondary prevention) - Attempts to reduce impact of ACEs on individuals in adulthood (i.e. tertiary prevention)	
Public Health approaches			
Routine enquiry – a requirement of staff within public services to ask about and routinely record information about ACEs	Whole services	- 'Trauma-focussed' encounters with clients/patients i.e. increasing understanding by practitioners of what has happened to their patients/clients and consequently why they might be in their current situation - Hence to improve client/practitioner relationships, create a more compassionate workforce and reduce violence within services	- Clarity about how ACE information is used (e.g. issues around child protection) - Appropriate services need to be in place to support treatment - Concerns about use of ACE questionnaires by untrained staff (especially if regarding children)

		- Early detection of ACEs during childhood in order to prevent/reduce negative impacts (i.e. Secondary prevention) - Attempts to reduce impact of ACEs on individuals in adulthood (i.e. tertiary prevention) by directing individuals to appropriate services	- Consider asking about more than the Kaiser Permanente ACE items - More than an ACE score needed – e.g. enquiry about severity, timing, context
Screening	Population/sub-populations	- Identify people who have experienced ACEs - Provide interventions that prevent poor outcomes	- Screening is not possible or appropriate here since ACEs are not an early stage of disease and, even if they were, evidence-based interventions to prevent their development into a full-blown disease state are not available
Use of ACEs information in treatment and treatment planning			
ACE-aware or 'trauma-focussed' individual or group treatment	Individual patients/clients	- More compassionate and 'trauma-focussed' encounters with the patients/clients with the aim of making correct assessments and planning treatment	- ACE score not as informative as information about severity, timing and context regarding individual ACEs

where there is already knowledge about ACEs		-Better surveillance to guide appropriate treatments e.g. trauma-focussed CBT – where trauma symptoms are linked with specific ACEs	- Simplistic recording of ACEs (e.g. in social work datasets) might mask multiple adversities - Clinicians must be careful not to assume that psychopathology stems entirely from ACEs, especially as we now know that individuals who have experienced abuse and neglect are more likely to also have complex neurodevelopmental problems